In addition to record-setting rainfall that could have filled the Houston Astrodome 3,200 times, Hurricane Harvey left behind a tremendous amount of debris. The Texas Commission on Environmental Quality estimated that this hurricane could have created 200–300 million cu yds of waste.

PHOTO: COURTESY OF MATT SWEENEY, PHILLIPS & JORDAN

Natural Disaster Preparation and Recovery

Rising Above

Proactive measures speed post-disaster recovery

By Erica Bender

WHAT'S INSIDE

Preparation: The Real Game Changer In Disaster Recovery

Last year, the United States suffered 16 major natural disasters, ranging from hurricanes and tornadoes to blizzards and wildfires. Beyond the thousands of lives lost, the economic damages were staggering—and are still climbing. The three biggest tropical cyclones of 2017 were also the year's costliest events: $133.5 billion from Hurricane Harvey, $120 billion from Hurricane Maria and $84.2 billion from Hurricane Irma (according to Moody's Analytics estimates). Western wildfires blazing through nearly 10 million acres were responsible for another $18 billion in damages.

Already in 2018, more than half a dozen severe weather events have wreaked havoc on the country—including Hurricane Florence last month, which battered the East Coast with torrential rain, hurricane-force winds, catastrophic flooding, landslides and storm-induced tornadoes. The 400-mile-wide storm didn't just flatten trees, buckle buildings and collapse roads—it also effectively disrupted the lives of millions. In addition to widespread power outages and property damages estimated between $38 million and $50 billion, the record-shattering floods created a slew of environmental calamities and compromised multiple water/wastewater systems.

While there is no way to avoid these and other natural disasters, municipalities and government entities at all levels can be more strategic in planning for them. Patrick McMullen, president of national civil construction firm Phillips & Jordan, shares one practice that helps to boost disaster response efforts.

"The disaster-recovery services market is a cottage industry, and within this industry there has been a steady shift toward the use of pre-position contracts," he says. In this type of arrangement, contractors specializing in disaster recovery are secured before an event occurs, helping to avoid procurement delays.

Typically, these multiyear, value-based agreements lock in pricing, terms and conditions under "blue-sky day" provisions. However, upon activation, the contracts often do not reflect market realities or the availability of qualified workers at that time. In 2017, when three major Atlantic hurricanes placed pressure on contractors to support recovery efforts in Puerto Rico, Florida and Texas, many could not find adequate resources to respond.

"Historically, in an isolated incident where you have limited damage, the pre-position contract model has worked. But in this instance, the contracts competed against each other because the supply curve was under pressure to the demand. Thus, contracts with the best prices captured all the resources," McMullen says. "For the first time, people had to go back to the drawing board and figure out what they were going to do to replace the contract vehicle they thought was going to respond."

What about surety provisions? Shouldn't these backstops come into play when contractors fail to render services, allowing contract holders to seek relief under the traditional surety structure? The simple answer: typically, no. "Sureties usually only issue a bond when contractors are activated—not when the contract is awarded," McMullen explains. This loophole, he adds, exposes a flaw in the pre-position structure, as there is no performance guarantee.

So, how can municipalities and government entities balance the perceived security of having a plan in place with changing, real-world market demands? "I think there needs to be a statewide pool of qualified contractors available—a second response if you will—in case counties need additional resources to supplement cleanup efforts or pre-position contractors are nonresponsive," McMullen says. "A pre-position contract is still a good concept, especially if it's procured in a best-value manner, where experience and qualifications are weighed in addition to pricing. Most companies doing work in this industry only bid this type of contract, so their advertised successes are based on contracts won—not contracts executed. With no guarantee that pre-positioned contracts lead to work on the ground, this can be misleading for those trying to gauge a candidate's experience with disaster work."

A Holistic, Proactive Approach to Resilience

While cataclysmic, random acts of nature cannot be prevented, certainly more can be done to prepare for them.

100 Resilient Cities (100RC), sponsored by the Rockefeller Foundation, is an initiative helping cities worldwide build resilience in the face of the social, economic and physical challenges of the 21st century. Panama City, part of 100RC since 2016, has faced a slew of catastrophes during its history, including earthquakes, fires and landslides.

PHOTO: COURTESY OF PANAMA RESILIENTE

Building up the resilience of communities is one solution worth considering. This holistic, proactive practice ensures systems endure—and even thrive—in a world imbalanced not just by physical shocks and stressors but also by adverse socio-economic trends that weaken the fabric of population centers on a daily or cyclical basis. Championing this approach is 100 Resilient Cities (100RC), one of many initiatives backed by the Rockefeller Foundation.

The idea behind 100RC is simple: help cities worldwide become more resilient to the physical, social and economic challenges that are a growing part of the 21st century. Cities in the 100RC network have access to a variety of resources, including support to develop and implement resilience strategies—usually with the help of a chief resilience officer hired by each city to coordinate interdepartmental efforts. "We see the cities in the 100RC network doing incredible work, indicating their sustained commitment for the long haul. They are building enabling environments for greater change as well as exhibiting strong signs of institutionalization and action around a resilience agenda," says Eugene Zapata-Garesché, 100RC's managing director for Latin America and the Caribbean.

Take, for example, Panama City, a densely populated urban center challenged by both extreme weather events (hurricanes and floods) and geophysical disasters (earthquakes, fires and landslides). "For Panama City, nestled in an intertropical convergence zone, water is both an opportunity and a risk. On one hand, its diversity of wetland ecosystems works to preserve water resources and ensure an immediate level of water availability. Yet unforeseen variations in the region's climate could compromise these ecosystems and the environmental services they provide, affecting the amount of water available to the urban population as well as the city's ability to mitigate its shocks and stresses," Zapata-Garesché says.

He continues, "Urban development has also seriously impacted Panama City's network of natural drainage systems, not only compromising flooding terraces and watersheds but also straining the city's combined storm drain and sanitation system. Leaving the city at greater risk to intense flooding events as a result, this has the potential to bring Panama City to a standstill, impacting transportation networks, communication infrastructure and commerce."

Earlier this year, 100RC tasked CSA Group with performing a prefeasibility study to enhance understandings of how Panama City coexists with water sources, ecosystems and climate change. CSA—a global provider of architectural, engineering and planning services—has been partnering with 100RC on projects since 2016. "On the Panama City project, we evaluated more than 10 technical studies conducted by private consultants and international aid organizations to identify data gaps or areas where further investigation was needed. The studies were specifically related to water resource issues, such as investigations of flood-prone areas, environmentally impacted wetlands and mangrove forests, freshwater supply and potable water demand obstacles," says Hans X. Figueroa-Sweet, CSA's technical leader for water resources and resilience.

Nine of the 10 recommendations presented by CSA were adopted in Panama Resiliente, an urban resilience strategy launched in August. This new "blueprint for resilience" contains 11 goals and 45 actions outlined along five main pillars: encouraging equal access to opportunities, enhancing infrastructure development while focusing on community integration, improving interactions between humans and wetlands, increasing public safety through comprehensive risk management and boosting community involvement in managing the city.

For more in-depth details about Panama City's new resilience strategy, visit www.100resilientcities.org/strategies/panama-city/. ◆

A Disaster Response Team With Heart

After Hurricane Harvey dumped close to 20 trillion gallons of rain over Texas, the employee-owners at Arizona-based Wilson Electric Services Corp. knew they had to help. Staff from Arizona and New Mexico formed a Disaster Response Team to support the hurricane cleanup and relief efforts in the Houston area, where nearly 80,000 homes had been flooded. In addition to delivering supplies to their Texas neighbors, the volunteers aided several homeowners in cleaning up their damaged properties.

PHOTO: COURTESY OF WILSON ELECTRIC SERVICES CORP.

Wilson Electric Services Corp. assembled 28 volunteers to help clean up and repair a total of eight properties impacted by Hurricane Harvey.

At one residence, the team removed all molding surfaces, replaced sheetrock and cleaned the entire space to reduce health risks to the two tenants: an elderly woman with Alzheimer's and the son who was her caretaker. When the storm threatened the livelihoods of two women whose sole income came from a small retail property, the crew performed various repairs at the 4,000-sq-ft building hard hit by water damage. For one military veteran in his 70s, a roof damaged by hurricane-force winds permitted water intrusion throughout his home. Volunteers assisted by removing all ruined carpet and some of the worst drywall spots. After learning that a 50-year-old breast cancer survivor was forced to remain in her rotting, waterlogged home because she was ineligible to receive government assistance, the team acted quickly to gut the entire house and clean an area for her to sleep free of mold and debris.

For the staff at Wilson Electric, these selfless acts of service are part of a company culture defined by building relationships—and going above and beyond to help others. ◆

Driving Innovation for Disaster Recovery Programs

Puerto Rico, the U.S. Virgin Islands, New York, New Jersey, California, Texas, Louisiana, Virginia and Florida all have something in common: each has recently faced the devastating impact of large-scale natural disasters. "Helping communities recover from and then thrive after disasters is our mission," says Rick Faircloth, director of state and local government programs for APTIM. He explains the complexity of the challenge and the journey through which American states and territories can rise from devastation to renewal—and how innovation, technology, creative program management and proper stewardship of federal funding are integral to the recovery process. He understands it because APTIM has tactically supported every major natural disaster in the United States since 2005.

Faircloth says the company provides comprehensive resiliency planning and risk-mitigation services to help communities survive, adapt and thrive in the face of environmental, social and economic shocks and stressors. When disasters do strike, APTIM is brought in to provide rapid-response emergency support. This includes getting shelters and temporary housing established, running large-scale debris removal programs, and assessing building and infrastructure damage—all with the goal of bringing facilities and utilities quickly back online. The majority of the work, though, is designing and delivering successful short- and long-term housing recovery programs, often requiring thousands of manhours and years of commitment.

"We understand that disaster recovery often feels like a marathon," says Domingo Camarano, a vice president in APTIM's government division. "However, it's our job to find quick wins that set the stage for long-term success. This approach helps us to earn the confidence of the people whom we are serving, while at the same time build synergy with the agencies we work for."

Tu Hogar Renace (Your Home Reborn)

A case in point is the ongoing recovery in Puerto Rico, where Hurricane Maria caused damage never before experienced by its current population. Initially, APTIM provided time-critical generator power for electricity restoration and Federal Emergency Management Agency (FEMA) Public Assistance (PA) technical advisory support to the Puerto Rican government. Today, just a little over a year since the hurricane's landfall, the company is working to take some of the complexity out of post-disaster housing recovery programs to speed up recovery, help communities become more resilient and create new economic opportunities in the aftermath.

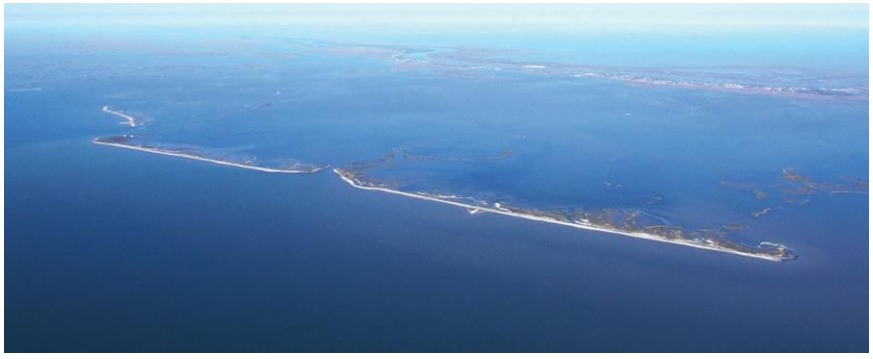
For example, APTIM and its partner, EE&G, developed a creative housing recovery program delivery model. "It's innovative, and it makes it easier for small local contractors to participate in large recovery programs by helping to identify local craft labor and managing the complex supply chain," Faircloth says. "It addresses logistics, payroll management, project accounting, permitting, compliance and federal grant paperwork. These functions are often too daunting or even impossible for local small businesses to navigate. By developing a system and process to manage these complex elements at the program level, the APTIM team removes hurdles to small business success, allowing local contractors to focus on their core competencies in residential repair and reconstruction."

APTIM's Project Manager Erika Morales explains that the company's "efforts are designed to not only contribute to more resilient housing but also to promote social and economic resilience in impacted communities by creating more jobs and building local capacity in the residential construction space so communities can be better prepared for future disasters."

"We are driven by the need for restoration for the families that are seeking a sense of normalcy in their lives," Camarano says. "There is nothing more satisfying than returning a clean, safe and habitable home to a family that was once displaced—to see the look on a mother's face who knows she can once again bring her family together around the dinner table."

APTIM FEMA PA technical advisors developed robust project worksheets to help the Puerto Rico Dept. of Transportation and Public Works (DTOP) obtain maximum reimbursement for damage sustained to its assets.

PHOTO: COURTESY OF APTIM



Innovative procurement and management strategies enabled the firm to construct 15 miles of emergency sand barrier berm in eight months to protect coastal Louisiana from the Deepwater Horizon oil spill.

The APTIM team provided 25 MW of time-critical generator power to support electricity restoration in Puerto Rico after Hurricane Maria.

Build It Back

Superstorm Sandy wrought massive damage in just a few days in 2012, but rebuilding continues. APTIM provides program management and staff augmentation for New York City's Build It Back program, which is funded through the U.S. Dept. of Housing's Community Development Block Grant Disaster Recovery (CDBG-DR). Through August 2018, the Build It Back program served some 9,000 eligible homeowners.

The development of a robust information management system was critical to the program's success, providing the foundation for good data and document management and achieving compliance with rigorous federal requirements. The system was developed and enhanced throughout the life cycle of the Build It Back program, with a focus on strengthening its capabilities and functionality over time and providing the city with better data integrity and visibility.

According to APTIM's Program Manager Sheila Manek, "it's all about continuous improvement and advocating for the communities we serve after disasters. We challenge the norms to find better ways to accelerate recovery, drive efficiencies, reduce cost and promote greater equity in recovery. As a result, the benefits of government-funded programs reach deeper and impact broader segments of affected communities."

In this instance, like in Puerto Rico, APTIM is helping the New York City Mayor's Office of Housing Recovery Operations to not only help people rebuild but to do it with resiliency at the forefront and in ways that will provide transformational change. For example, the Build It Back program is helping those living in the hardest-hit waterfront communities to not only rebuild but to elevate about 1,375 homes and comply with improved stringent flood-compliance regulations.

Big Challenges Require Big Solutions

Last December, the City of Houston, the fourth-largest city in the United States, awarded a master program manager (MPM) contract to APTIM to assist in helping homeowners continue to rebuild after Hurricane Harvey. The program is funded through $1.2 billion in CDBG-DR funds and $450 million allocated by FEMA. APTIM is

A Bright Spot for Children

When APTIM employees went to work to help repair and clean up schools in the U.S. Virgin Islands that were damaged after hurricanes Irma and Maria, they brought with them a culture of mission-driven service. Moved by the hurricane-related hardships kids in the territory faced, including closure of some schools and forced half-day education sessions, the company wanted to do something special to celebrate the on-time opening of the schools it had repaired.

APTIM Project Manager Hab Karam and his team felt a shared personal responsibility to make sure students felt a warm welcome when they returned for the 2018 school year. After a few phone calls, Karam's APTIM colleagues in Texas were busily scouring teacher supply stores on the mainland and purchasing fun decorations, welcome signs, and instructional and inspirational art and supplies to liven up the barren school lobbies, hallways and classrooms. Before the schools opened, APTIM employees and their subconsultants in the Virgin Islands donated their time to decorate classrooms and build corkboards so that the students would feel important and welcome.

"Working for APTIM is no nine-to-five job," Karam says. "We put our hearts into our work and the people we serve." ◆

APTIM performed temporary repairs and cleanup of schools in the U.S. Virgin Islands impacted by hurricanes Irma and Maria.

PHOTOS: COURTESY OF APTIM

Disaster Response Experts Speed Recovery in Puerto Rico

Communication. Coordination. Collaboration. These actions are all critical to expediting recovery efforts in Puerto Rico, where Hurricane Maria disrupted the lives of millions in September 2017. Shearing winds, flooding and landslides destroyed homes and public infrastructure, and also knocked out power, water and cellular service.

In response, the governor of Puerto Rico authorized the creation of a program management office (PMO) to speed repair and reconstruction efforts. The PMO support team is utilizing an array of in-house engineers, planners, architects, construction managers, program managers, and environmental and permitting specialists. As part of the PMO solution, CSA Group is delivering comprehensive emergency management and disaster recovery services designed to ensure Puerto Rico optimizes its reimbursement for disaster-related damages from all available federal sources.

CSA Group's dam-safety experts assisted with damage assessments and developing emergency repair alternatives at the Guajataca Dam in Puerto Rico.

PHOTO: COURTESY OF CSA GROUP

CSA mobilized with resources at the Joint Field Office in Puerto Rico within a week after the passage of Hurricane Maria. One critical assignment was to ensure safe, uninterrupted water service for 200,000 residents in the northwest region, which relies on the Guajataca Dam for water supply. Record rainfall in the watershed exceeded 2 ft in 24 hours, eroding the emergency spillway and washing away associated infrastructure, such as power, water supply and distribution pipelines, and roadways. CSA collaborated with the task force led by the U.S. Army Corps of Engineers on geotechnical, structural and hydraulic calculations and developing scope work and cost estimates for repair alternatives required for grant funding requests. The dam was stabilized within 60 days. ◆

Rapid Response in U.S. Virgin Islands

PHOTO: DESIMONE CONSULTING ENGINEERS

Following the impact of hurricanes Irma and Maria, DeSimone Consulting Engineers mobilized multiple senior-level personnel to begin the triage and assessment of more than 130 properties owned or operated by insureds of their clients. Utilizing commercial and private aircraft, ferries and charter watercraft, engineers rapidly accessed locations on the islands of St. Thomas, St. John and St. Croix that were without power and had limited-to-no cellular communications. The firm's mobile response teams employed technology including multi-sensor sUAS (drones) to capture imagery, in addition to a robust, portable data server and satellite-based communications to log and transmit field conditions data back to mainland-based offices. ◆

Advertiser Index

APTIM managed the first large-scale FEMA Sheltering and Temporary Essential Power (STEP) emergency housing program supporting 20,000 residents in New York City after Superstorm Sandy.

managing all aspects of the program, from prequalifying homebuilders to developing prequalified vendor data to compliance and monitoring oversight. The program will allow for various solutions to meet individual needs, once again allowing for resiliency and a variety of best-use scenarios to benefit the homeowners while assuring wise stewardship of the invested funds. The APTIM team is collaborating with the city to leverage new disaster-recovery technology that will drive efficiencies in the management of CDBG-DR programs and improves collaboration between homeowners, contractors and city officials to deliver homes that meet federal grant requirements. ◆

A History of Disaster Recovery

While APTIM's 10,000 employees are working on about 4,000 projects in 80 countries, their work on disaster recovery in the United States remains a cornerstone of their activities. This timeline offers a sense of the breadth of their work.

2005

Hurricane Rita: Full recovery management work for FEMA, including site assessments and facility inspections

Hurricane Wilma: Damage assessments and managed building and installation of temporary and group housing

Hurricane Katrina: Constructed group housing sites, cleared waterways, designed and built hurricane-protection infrastructure, installed utilities, built roads and water treatment plants

2008

Hurricane Gustav: Mobilized 300 debris monitors in two weeks, managed 2.2 million cu yds of debris, monitored removal of 13,000 trees

Hurricane Ike: Removed 12 billion gallons of floodwater, performed inspections, completed county-wide environmental review, including 1,000 site-specific analyses

2010

BP Oil Spill: Moved 20 million cu yds of material in six months, constructed more than 15 miles of barrier berm

Earthquake in Haiti: Provided temporary housing for Canadian embassy, dispatched a team to perform preliminary island site assessment within three days, constructed and installed electricity, communications, water and power systems

2011

Tornado in Joplin, Mo.: Supported FEMA in mass care/housing mission and constructed group and commercial park facilities

Wildfire in Bastrop County, Texas: Managed housing program and restored 24 drainage infrastructure sites

2012

Hurricane Sandy: Program management consultant to New York City, mobilizing 250 disaster-response professionals and 200 subcontractors; assisted in restoration of 29,000 residences in four months; program management for New York City Housing Authority; program management for the New Jersey Dept. of Community Affairs.

Hurricane Isaac: Monitored removal of more than 13,000 trees, mobilized more than 300 debris monitors in two weeks, managed 2.2 million cu yds of debris

2016

Hurricane Matthew: Emergency planning, grant management, FEMA program management, mass care and temporary housing

2017–Present

Hurricanes Harvey, Irma and Maria: Grant management, FEMA program management, housing and mass care management, Puerto Rico emergency management services

PHOTO: COURTESY OF APTIM

Electronic Debris Management Reduces Errors and Improves Accountability

Following a historic super-outbreak of tornadoes in April 2011, the federal government orchestrated a massive debris management mission across 24 counties in Alabama, one of the states hardest hit by the devastating storms. Spearheaded by the U.S. Army Corps of Engineers (USACE), these cleanup efforts included the removal of nearly 5 million cu yds of debris from both land and waterways.

Phillips & Jordan was contracted to provide debris management support to 41 FEMA applicants in Alabama. To increase efficiency on this USACE project, the heavy-civil construction firm deployed its proprietary automated debris management system (ADMS). Developed in 2004, this paperless technology eliminates the need for data entry and multiple data sets, expedites daily reporting as well as invoice reconciliation and auditing, and maps project performance.

Through ADMS, accountability is enhanced because inspectors can enter the field at the same time as debris-removal crews to document work in real-time. Clients appreciate these live updates because they show the status and locations of all project activity. In addition to capturing project information electronically, the digital system creates a more transparent audit trail to ensure taxpayers' funds are used appropriately.

In Alabama, the use of ADMS ultimately provided USACE with greater operational awareness and insight, enabling the agency to identify and address multiple inefficiencies, which helped to trim down overall costs on future disaster response missions. To learn more about this project and others performed by Phillips & Jordan, visit www.pandj.com. ◆

Over the past three decades, Phillips & Jordan has supported the disaster response and recovery efforts of entities nationwide following virtually every major federally declared disaster.

PHOTO: COURTESY OF PHILLIPS & JORDAN

Devastation Leads to Innovation

Hurricane Harvey, a Category 4 storm that devastated the Texas coast in August 2017, set records in every category from rainfall to historic damage. Despite flooding Texas with 19 trillion gallons of water and displacing nearly 780,000 people, this catastrophic event encouraged developmental improvements and engineering innovations.

Following the storm, Walter P Moore's Water Resources and Application Development teams partnered to create a Floodplain Elevation Tool. This dynamic, interactive tool navigates a web-based map while providing flood elevations and stream flood profiles within the watersheds of Harris County and the city of Houston. It also has tremendous implications for the residents of Harris County, allowing them to easily access flood data and evaluate whether their properties lie within the floodplain.

In an effort to help property owners evaluate their flood risk, Director of Civil Engineering Charlie Penland developed a Flood Risk Checklist. This resource prompts users to look at a potential flood source, such as a stormwater detention pond, and provide criteria against which to evaluate their properties and seek appropriate solutions. In addition to complementing several international speaking engagements on the topic, the checklist was issued both as a microsite and a digital download.

"Each storm is a different lesson, and we need to make sure that we are learning from all of them," Penland says. "Take advantage of the opportunity this storm has brought about—the opportunity to change things." ◆